File No. C2270
Catalog No. 1553
Serial No. 7A39
#1

Lens:
f: 1.9
Serial No. A28892

BOMARC Test Equip. Store

Du Mont
Oscillograph Record Camera

TYPE 297

RETURN TO
BOMARC
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COPY NO. 1

OPERATING AND MAINTENANCE MANUAL

Allen B. Du Mont Laboratories, Inc.

CLIFTON • • • NEW JERSEY

Obviously, the design of any scientific instrument results from a series of compromises which represent the designer's opinion of an ideal instrument consistent with contemporary engineering techniques and present-day production possibilities.

In developing this instrument, an attempt has been made to incorporate those characteristics which, we believe, will satisfy the greatest number of applications.

We feel, however, that the real test of any instrument is the opinion of the man who uses it. This day-to-day test of the instrument's advantages and limitations will prove, more than any other method, just what characteristics are desirable.

Because of the nature of the equipment manufactured by Allen B. Du Mont Laboratories, Inc., it is only by complete cooperation between the customer and our Engineering Department that satisfactory designs can be achieved. In a continuous attempt to increase the applicability of our equipment to the problems of the engineer, we sincerely request suggestions advising in what manner the design of this equipment may be further extended to include these problems.

TYPE 297 OSCILLOGRAPH-RECORD CAMERA

REVISION SHEET

To produce good recordings of waveform data by means of the data-record system of the Type 297, the information given in Section IV, paragraph 4 and Table 4-2, of the Operating and Maintenance Manual should be modified to read as follows:

SECTION IV
OPERATION

4. RECORDING DATA ON THE POLAROID - LAND PRINT

Written data concerning the waveforms being recorded may be photographed on the same print as the waveform itself by use of the data-record system. The data image should be located at the top of the frame and be photographed only once. The surface on which the data is written is illustrated in Figure 2-1b.

To record data on the print:

a. Slide the camera to its forward position (see Figure 4-14) to locate the data image at the top of the frame.

b. Open the data-record door, and write on the ground-glass surface within the rectangular area inscribed by the black line. This rectangle indicates the limits of satisfactory data-recording area.

c. Close the door and press the push button on the left side of the camera. This illuminates the data surface.

d. Press the cable release allowing for approximately the exposure time shown in Table 4-2. Data may be double-exposed on the film with the oscillogram or may be recorded simultaneously by proper adjustment of both the cathode-ray beam intensity and the iris diaphragm. If simultaneous exposure of the data record and the oscillogram is desired, the iris diaphragm and intensity control settings should be adjusted so that the same exposure time yields a suitable record of both the data and the oscillogram. Otherwise the data and oscillogram exposures should be made separately according

to the data given in Tables 4-1 and 4-2.

10. DATA - RECORD EXPOSURE

TABLE 4-2

NOTES:

1. These exposures are for handwritten data on the ground-glass surface with a No. 2 soft pencil and for a fresh dry cell.
2. For best results it is recommended that only the first three apertures be used for data-record exposure. The use of apertures smaller than f/4 will result in reduced useful recording area with the possible loss of information.

Part No. 67011341

ALLEN B. DUMONT LABORATORIES, Inc.
INSTRUMENT DIVISION
760 Bloomfield Avenue, Clifton, N. J., U.S.A.

OPERATING AND MAINTENANCE

MANUAL

DU MONT

TYPE 297

OSCILLOGRAPH RECORD CAMERA

RETURN TO
BOMARC
TEST EQUIPMENT STORE
COPY NO. 1

ALLEN B. DU MONT LABORATORIES, INC.
INSTRUMENT DIVISION
1500 MAIN AVENUE, CLIFTON, N.J., U.S.A.

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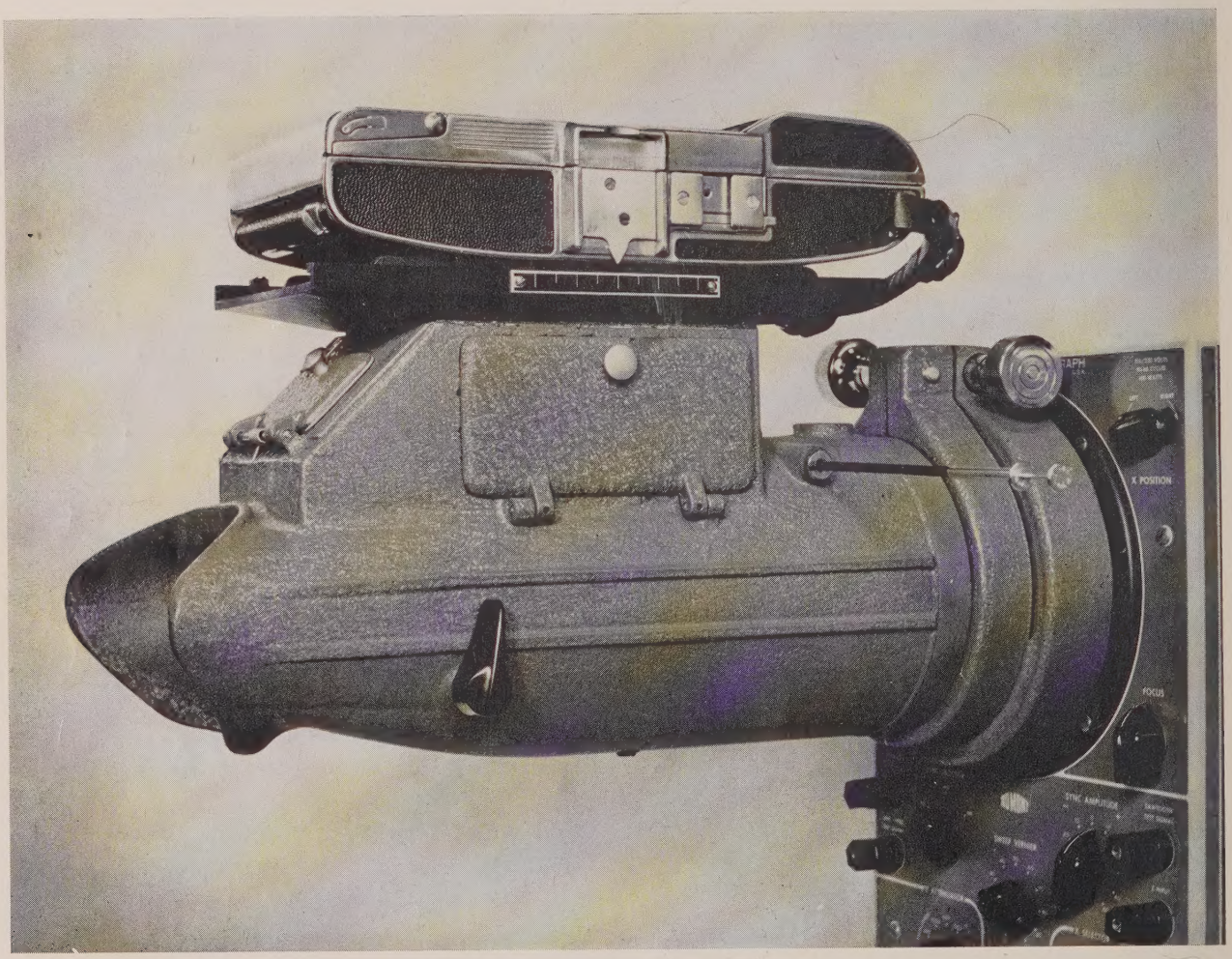

FIGURE 1-1

DU MONT TYPE 297 OSCILLOGRAPH-RECORD CAMERA

SECTION I

GENERAL DESCRIPTION

1. GENERAL

Often it is convenient or necessary to obtain a photographic-recording of an oscillograph's trace in the shortest possible time. The Du Mont Type 297 Oscillograph-record Camera, shown in Figure 1-1, has been designed to meet this need. Operating on the Polaroid-land principle, the Type 297 produces a finished oscillogram 60 seconds after exposure.

The Type 297 Camera features a combination of optics specifically selected for cathode-ray recording, simultaneous binocular viewing, and built-in data recording system. The optical system used makes possible the recording of all stationary patterns, as well as low and medium-speed transients.

For camera specifications see Table 1-1.

2. RECORDING MATERIAL

Polaroid-Land film, Type 41 (black and white), is available at most photographic supply stores. A single loading pack contains enough material for eight 3-1/4 by 4-1/4 frames. Moreover, with the Du Mont Type 297 Oscillograph-record Camera, it is possible to make a number of exposures on a single frame.

3. APPLICATIONS

The Type 297 Oscillograph-record Camera will increase the usefulness of an oscillograph since it converts an oscil-

TABLE 1-1
SPECIFICATIONS

Camera: A specially adapted Polaroid-Land Camera designed for oscillographic work.

Lens: F/2.8, 75mm, coated, or F/1.9, 75mm, coated.

Shutter: No. 2 Alphax used with Wollensak F/2.8, 75mm lens. Incorporates Time, Bulb, 1/100, 1/50, 1/25 shutter speeds.
No. 3 Alphax used with Wollensak F/1.9, 75mm lens. Incorporates Time, Bulb, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2 shutter speeds.

Focus: Fixed; but can be adjusted for special oscillographic work.

Object to Image Ratio: 2.25.

Print Size: 3¼" x 4¼".

Maximum Photographic Writing Speeds: Eight inches per microsecond at an over-all accelerating potential of 12 KV when using Polaroid-Land Type 40 emulsion; one inch per microsecond under the same conditions when using Polaroid-Land Type 41 emulsion.

Mirror Housing: Contains dichroic beam-splitter mirror for simultaneous binocular viewing and recording; camera-housing easily clamps to front bezel of 5-inch oscillograph; comfortable eye shield reduces external ambient light.

Data Card Housing: Built into mirror housing and containing two miniature lamps, dry cell, and push-button switch for making exposures. Data is inscribed in pencil on ground glass surface in data-record window and may be recorded simultaneously with oscillogram.

Approximate Physical Dimensions:
Length: 14⅜".
Height: 10".
Width: 6".
Weight: 12 lbs.

lograph into a recording instrument. For example, the Type 297 may be used to document a research development project. The Type 297 may also be used in quality control work to make performance records, which may be used to prove the attainment of contract specifications. Moreover, since finished prints are available one minute after exposure, hours of time normally spent in the darkroom are saved.

One feature of this camera, which facilitates test work requiring a sequence of exposures, is the sliding camera-back mechanism. This camera-back may be positioned for any desired number of oscillograms per frame, up to a maximum of nine.

When quantitative measurements are to be made from an oscillograph, the Type 297 serves an important function. An oscillograph-record camera is required for quantitative analysis of single-transient phenomena since such patterns remain on the cathode-ray tube for too short a time, even with long-persistence screens, for detailed analysis. For quantitative analysis of stationary patterns, an oscillograph-record camera facilitates measurements and eliminates the possibility of parallax error.

When employing extremely slow sweeps where the flicker of the trace prevents satisfactory observation, a recording camera is useful. Also lacking a multi-channel cathode-ray oscillograph, the Type 297 may be used to double-expose two or more patterns for close comparison.

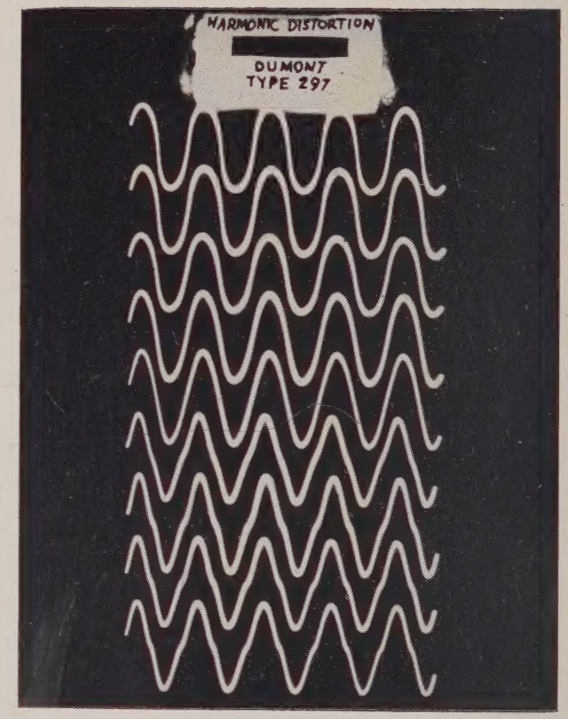

FIGURE 1-2

OSCILLOGRAM ILLUSTRATING EXPOSURE OF SEVERAL WAVEFORMS ON ONE FRAME. EACH OF THESE WAVEFORMS CONTAIN DIFFERENT DEGREES OF HARMONIC DISTORTION CAUSED BY A NON-LINEAR CIRCUIT PARAMETER

SECTION II

DETAILED PHYSICAL DESCRIPTION

1. GENERAL

The Type 297 Oscillograph-record Camera is shown in Figures 2-1a and 2-1b. It consists basically of the following components:

a. A Polariod-Land Camera back especially adapted for the recording of oscillograms.

b. LENS ASSEMBLY.—The f/2.8, 75mm lens assembly is equipped with a No. 2 Alphax shutter. The shutter calibrations are: time, bulb, 1/100, 1/50, and 1/25 seconds. The iris diaphragm scale is calibrated in steps of f/2.8, 4, 5, 6, 8, 11, 16, and 22. The f/1.9, 75mm lens assembly, available optionally, is equipped with a No. 3. Alphax shutter. The shutter calibrations are: time, bulb, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2, and 1 second. The iris diaphragm calibrations are f/1.9, 2.8, 5.6, 8, 11, and 16.

c. CAMERA HOUSING.—The cast aluminum housing contains a dichroic beam-splitter mirror, a data-recording mirror, a data-record chamber, and an eye shield for binocular viewing.

d. An aluminum tongued and grooved sliding assembly is provided to adapt the Polaroid-Land Camera to the housing.

Observation of the trace on the screen is accomplished through the *eye shield* and a *viewing door,* which can be opened and closed by means of a lever knob.

2. OPTICAL SYSTEM

The optical system of the Type 297 is shown schematically in Figure 2-2. The objective lens consists of a specially designed Wollensak f/2.8, 75mm lens system[1] for covering the required field at a 2.25 to 1 object: image ratio. The dichroic beam-splitter, which is the heart of the system, is of the interference type rather than the partial reflecting metallic coated type of mirror. An interference mirror consists of a number of transparent dielectric films of precisely controlled thickness deposited on flat glass. When the films are properly arranged with regard to their number, thickness, and refractive index,

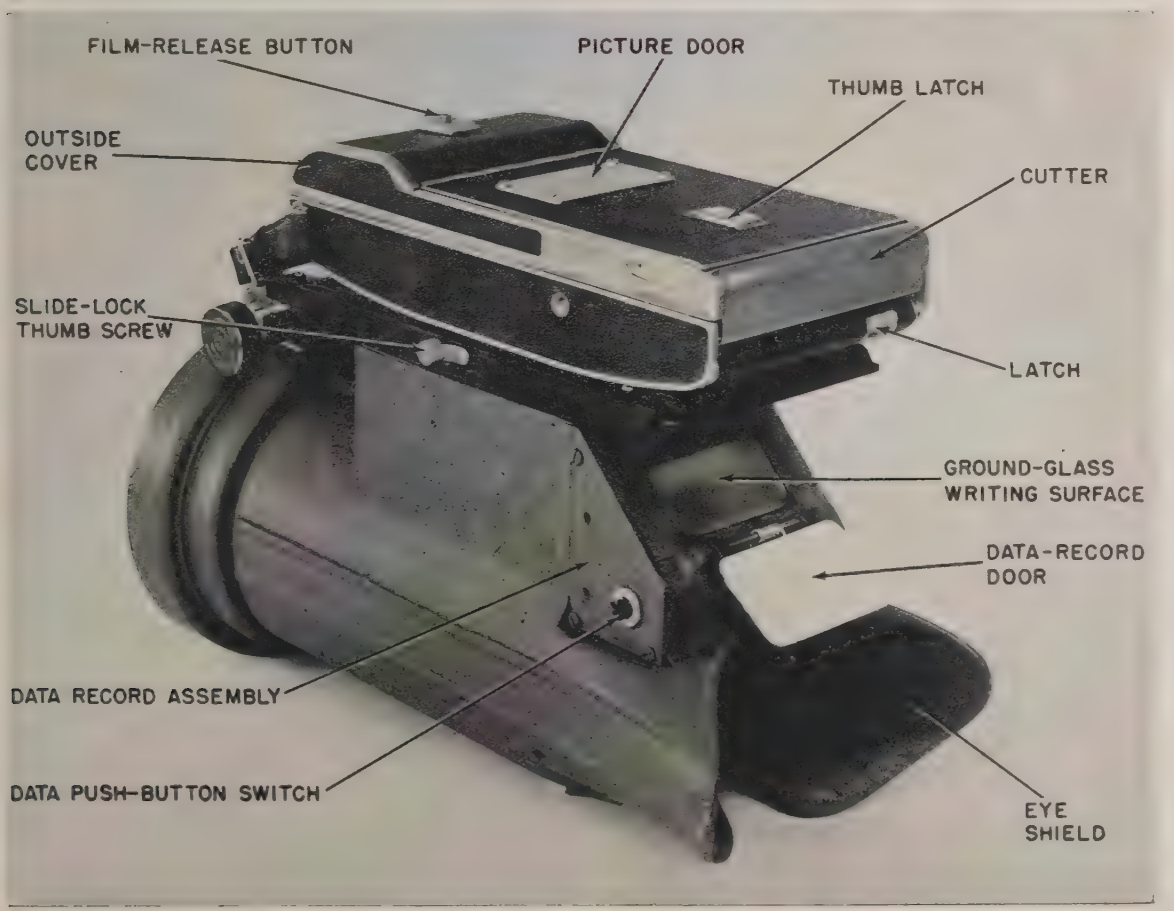

FIGURE 2-1A COMPONENT IDENTIFICATION, LEFT SIDE

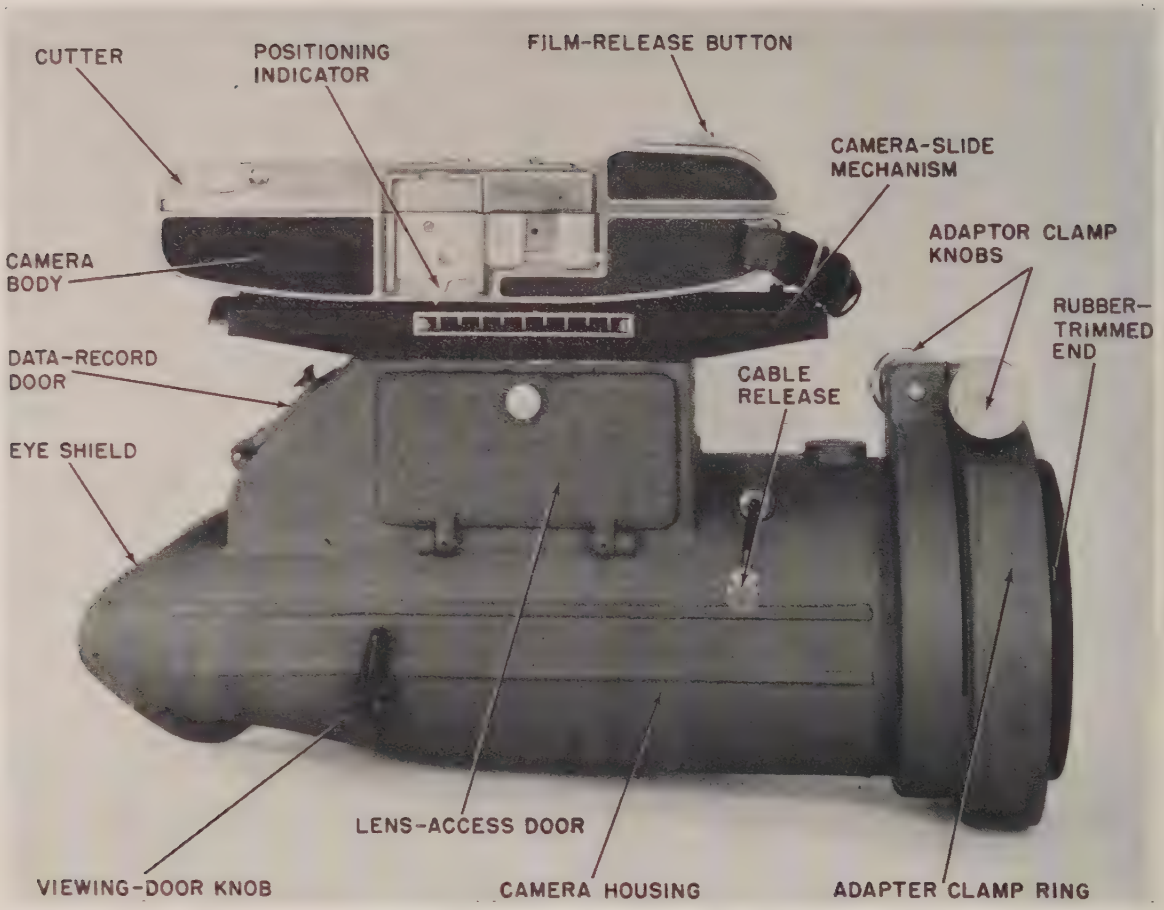

FIGURE 2-1B COMPONENT IDENTIFICATION, RIGHT SIDE

a chromatic selection takes place in which a certain portion of the spectrum is reflected and the remainder is transmitted. Thus the name "dichroic" is given to this beam-splitter. Transmission losses owing to absorptions are negligible in this type of beam-splitter. The dichroic beam-splitter used in the Type 297 is designed to reflect actinic light (blue) and transmit yellow light when the light rays are incident at 45°.

The spectral reflectance characteristic of the beam-splitter for the Type 297 was chosen so that over 85 per cent of the photographically useful light for a Type P11 screen is transmitted to an orthochromatic emulsion such as Polaroid-Land Types 40 and 41. A spectral reflectance characteristic curve of the beam-splitter is shown in Figure 2-3. This curve refers to a 45° incidence angle for which the beam-splitter is designed. Operation of the system is as follows:

The cathode-ray tube pattern is reflected upward by the front surface of the 45° beam-splitter and passes through the objective to form an image of the focal plane. As shown in Figure 2-3 only the blue and blue-green components of light are reflected. The remainder of the luminescence (yellow component) is transmitted through the mirror to the es. Thus the beam-splitter provides the most s means for simultaneous direct binocular view ıe recording. The mirror housing, which is shaped to . he head and shield the eyes, greatly reduces the possibility of visual parallax because the observer always sees the pattern from the same central position.

It must be kept in mind, however, that the beam-splitter mirror causes the oscillogram on the print to be upside down with respect to the trace position as viewed directly on the cathode-ray tube. In other words, a positive going signal will be downward on the Polaroid-Land print.

If it is necessary for positive signals to appear upward on the final print, the cathode-ray vertical deflecting plate connections may be interchanged. The paper negative in the Polaroid-Land Camera back will reproduce an image exactly as it appeared on the cathode-ray screen. This negative may also be used instead of the print if the fixing procedure described in Section IV, Paragraph 5, entitled "Reproduction of Polaroid-Land Records" is used.

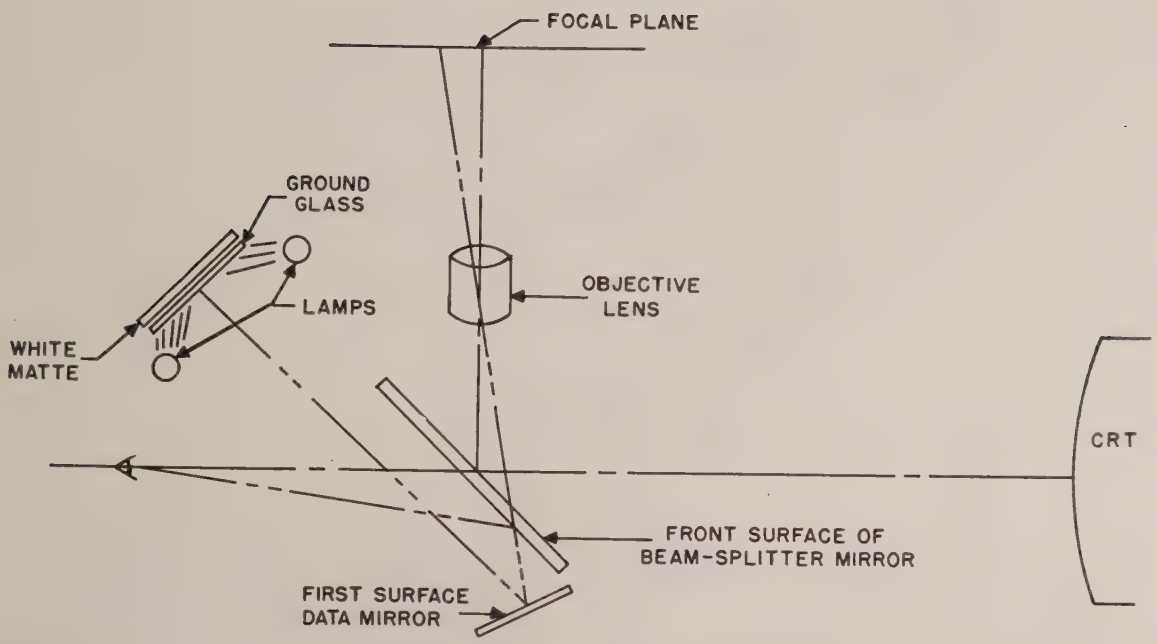

FIGURE 2-2 OPTICAL SYSTEM OF TYPE 297

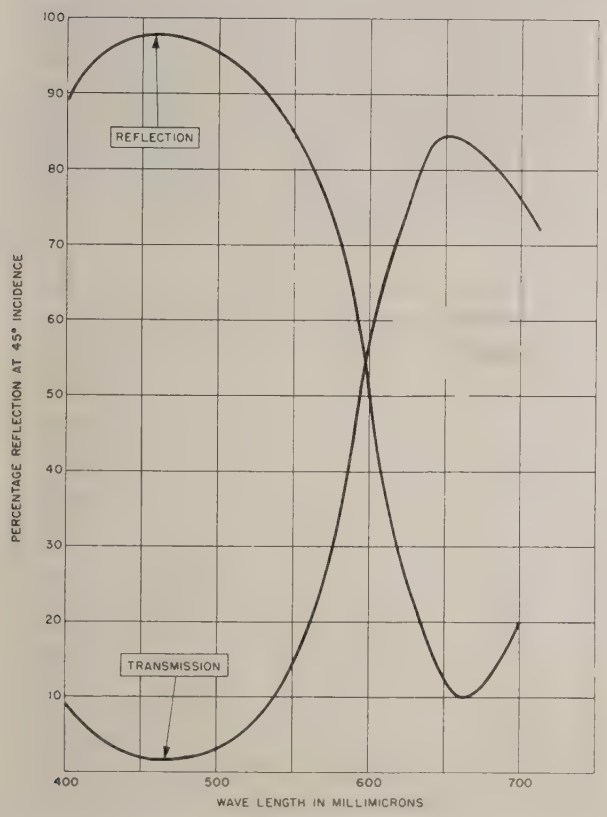

FIGURE 2-3
SPECTRAL REFLECTION AND TRANSMISSION CURVES OF DICHROIC MIRROR

3. DATA-RECORDING SYSTEM

A data-recording system is provided which makes it possible to record handwritten data on a ground-glass surface. This data-recording system is arranged so that the data can be seen through the eye shield simultaneously with the beam trace.

Both the oscillogram and data record are photographed by the lens through a single reflection from the dichroic and data-record mirrors respectively. The optical system, shown in Figure 2-2, also shows the data recording system schematically.

Light from lamps located in the data-record housing passes through a piece of ground glass, and is reflected from the white-matte plastic surface. Data may be written with an ordinary soft pencil on the ground-glass surface. If desired, such data, as the face of a watch or counter, may be recorded by opening the hinged door and placing the object against the ground glass. The ground glass should be removed, for this application, unless the surface to be recorded can be placed in close contact with the glass surface.

4. MIRROR AND DATA-RECORD HOUSING

This housing, a machined aluminum casting, is shown in Figure 2-1b. One end is cast in the shape of a viewing shield for comfortable binocular viewing. The other end fits the standard adaptor clamp ring which is supplied with the camera. The top of the casting is rectangular in shape to accommodate the camera adaptor mechanism. The

right side of the rectangular section contains a lens-access opening through which the lens, iris diaphragm, and shutter are adjusted.

The data-record assembly is located at the top of the camera housing just above the eye shield. (See Figure 2-1b). This unit contains two lamps, a push-button switch, and a dry cell mounted on a single assembly. It can readily be removed from the camera housing for replacement of the dry cell or lamps. (See Figure 2-4 and 2-5).

The window of the data-record assembly is fitted with a spring return door which is covered with a white, plastic, reflecting surface. The window and data-record door are located at a convenient angle for writing and are so arranged that data inscribed on the writing surface will be recorded in proper relationship to the oscillogram. A ground-glass light diffusing plate covers the opening under the door. This also serves to prevent erasings and other particles from entering the mirror housing. The inside of the housing contains cast supports for the dichroic beam-splitter, the dichroic beam-splitter mirror, a data-mirror assembly, and a spring-loaded door to block the viewing window when not in use. The end of the housing which fits into the adaptor clamp ring, is fitted with a rubber trimmed end which contacts the cathode-ray tube or calibrated scale.

5. ADAPTOR CLAMP RING

The adaptor clamp ring is designed to be attached to a standard Du Mont Type 2501 Bezel. The larger diameter of this ring is attached to the bezel, while the smaller diameter is attached to the camera housing.

FIGURE 2-4
SLIDING DATA-RECORD ASSEMBLY FROM HOUSING

FIGURE 2-5
DETAIL OF DATA-RECORD ASSEMBLY

SECTION III

INSTALLATION

1. INITIAL INSPECTION OF CAMERA

After unpacking the camera, the following inspection procedure is suggested: (Refer to Figure 2-1 for overall views of the Du Mont Type 297 Oscillograph-record Camera).

a. Open the viewing door by rotating the viewing-door knob clockwise until a catch is engaged.

b. Examine the dichroic and data-card mirror for an excessive amount of surface dust by looking into the barrel end of the housing. These mirrors should only be cleaned with fine lens tissue or by dusting with a soft camel-hair brush.

c. Open the lens-access door on the right side of the housing and check operation of the iris diaphragm and shutter controls. The shutter speed is selected by rotating the knurled ring at the bottom of the assembly. The iris diaphragm opening is selected by moving the small pointer above the knurled ring. (See Figure 4-11). To determine whether the IRIS DIAPHRAGM and SHUTTER are operating properly, open the camera back (see Section V, Step 3) to expose the inner lens. Check all positions of the shutter, and then with the shutter open, rotate the aperture control, observing the operation of the diaphragm.

2. INSTALLATION OF LEAK-PROOF DRY CELL

The dry cell, which supplies data-card illumination, comes packed in a separate container. To install this dry cell, remove the three screws (on the left side of the camera housing) that hold the data-chamber cover plate in place. Slide out the data-light assembly bracket as shown in Figure 2-4 and snap dry-cell into place as in Figure 2-5. Before replacing the data-light assembly bracket into the camera housing, check operation of the lamps by depressing the red push-button switch.

3. MOUNTING CAMERA ON OSCILLOGRAPH

a. The Type 297 Oscillograph-record Camera is designed to mount on the Du Mont Type 2501 5-inch Bezel. If an oscillograph does not have this bezel, one may be purchased separately from Du Mont. The Type 2501 Bezel may be readily attached to all 5-inch oscillographs.

b. Remove the adaptor clamp-ring from the camera housing by rotating the knurled knob closest to the camera body counter-clockwise until the ring becomes free and can be slipped off over the rubber-trimmed end. *Care should be taken to rotate this knob only as much as necessary to permit removal of this ring. Rotating the knob too far may cause the screw-retainer ring to be sprung.*

c. Attach the adaptor clamp-ring (designed for Du Mont Type 2501 Bezel) to the bezel of the oscillograph. The adaptor clamp ring should be attached to the bezel so that the knurled knob will not interfere with normal operation of the oscillograph controls. The best position is generally with the knobs on top, although exact positioning is not required.

d. Next, slowly insert the camera housing into the adaptor clamp ring until the rubber-trimmed end just touches the face of the cathode-ray tube or the calibrated scale. Tighten the knurled knob closest to the camera body to hold the camera in place. The camera housing should be located so the top of the camera is parallel with the top of the oscillograph cabinet. (See Figure 1-1). When the camera is mounted in this way the oscillographic trace will be recorded across the width of the film, perpendicular to the edges.

SECTION IV

OPERATION

1. THE POLAROID-LAND PROCESS

The Polaroid-Land photographic process is sometimes known as a soluble silver complex process. It involves the simultaneous development of both positive and negative images in adjacent layers of photographic material, the positive image being formed from the unexposed silver halide grains of the negative image. The adjacent layers in the Polaroid-Land process, consist of a paper negative halide emulsion, and a positive printing paper coated with crystals of metallic sulfide. Attached to the printing paper at the head of each frame, is a small air-tight "pod" which contains a chemical reagent and plasticizer. After exposure of the paper negative, the negative-emulsion surface and the positive-printing surface are pulled together and pressed firmly between steel rollers. Thus the pod is broken, and the jellied reagent is spread evenly in a thin film between the adjacent layers. The exposed grains of silver halide in the negative emulsion are thereby developed into metallic silver, while the unexposed silver halide grains are dissolved. These unexposed grains diffuse out of the negative emulsion into the immediately adjacent positive-printing surface. Sulfide crystals on the printing surface cause the silver solution to precipitate as a positive image on the printing surface. The entire process requires about 60 seconds at normal room temperatures. Since any excess developer is trapped and resealed, it is not generally possible for the operator to come into contact with the reagent during the normal operation of the camera. However, if occasion to examine the reagent arises, caution should be observed since the chemicals employed will stain clothing permanently.

2. LOADING THE CAMERA

It is recommended that the Type 297 be mounted on an oscillograph before loading, to facilitate this operation. (For instruction on mounting the Type 297 Camera on an oscillograph, refer to Section III.

Step 1:

Loosen the *slide-lock thumb screw,* and slide the camera along its track to a position farthest from the oscillograph. (Figure 4-1).

Step 2:

Lift the *cutter bar* by applying a firm but gentle pressure at the base of the bar. (Figure 4-2).

Step 3:

To unlock the *outside cover,* swing the *latch* down and to the left. (Figure 4-2).

Step 4:

Lift the *inside* and *outside covers* and lay them back. (If the camera has been used previously, remove and discard the empty spool). Wipe the two steel rollers clean. (Figure 4-3).

Step 5:

Unroll the film wrapper (being careful not to break the tape seal); press the spool firmly into place in the slots provided, and drop the paper roll into its compartment. (Figure 4-4).

Step 6:

Draw the wrapper out as shown in Figure 4-5 and close the *inside cover.*

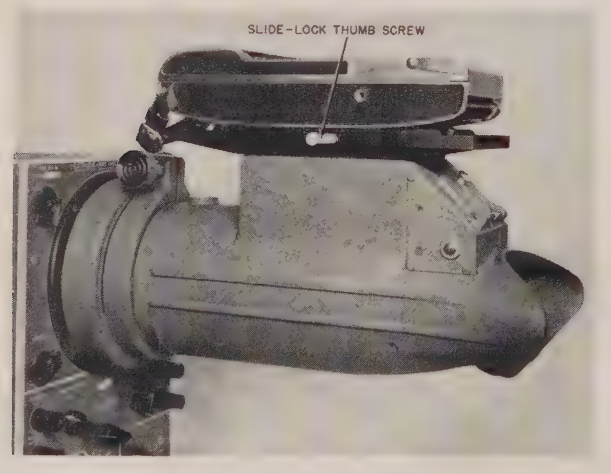

FIGURE 4-1
LOOSENING THE *SLIDE-LOCK THUMB SCREW*

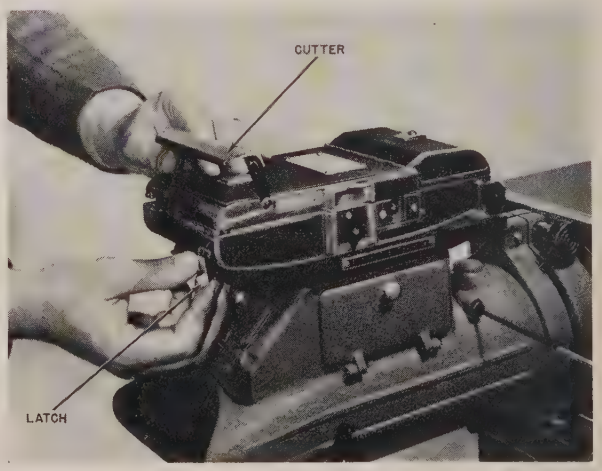

FIGURE 4-2
UNLOCKING THE *OUTSIDE COVER*

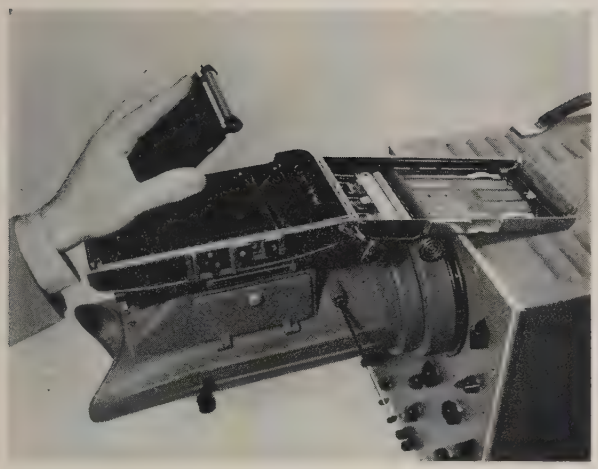

FIGURE 4-3
LIFTING THE *INSIDE* AND *OUTSIDE COVERS*

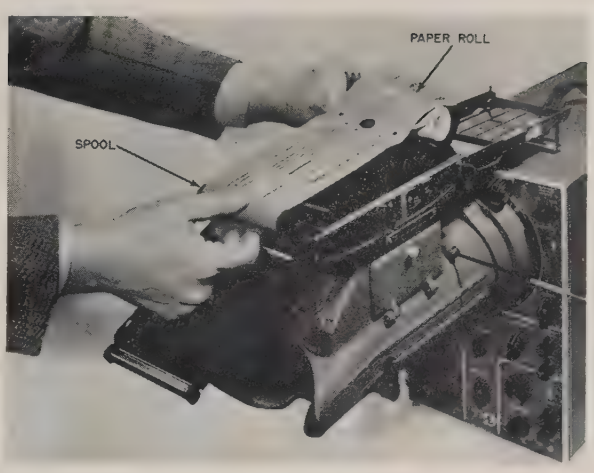

FIGURE 4-4
LOADING THE FILM

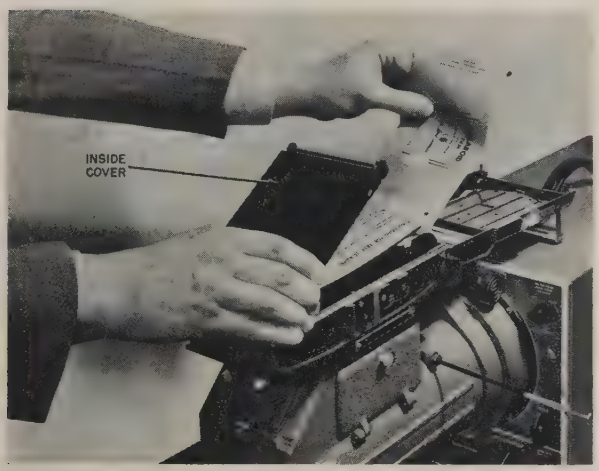

FIGURE 4-5
CLOSING THE *INSIDE COVER*

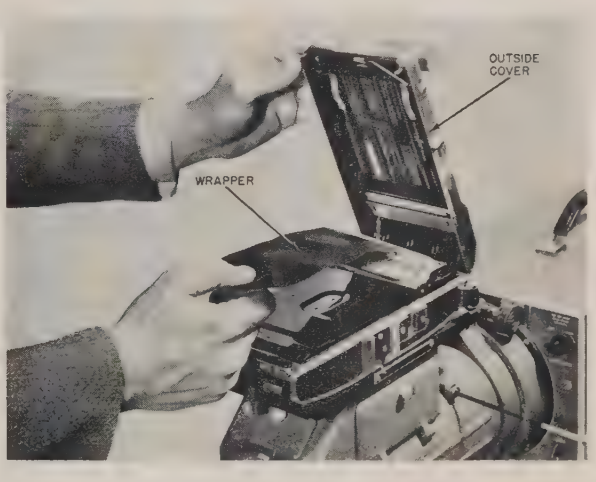

FIGURE 4-6
CLOSING THE *OUTSIDE COVER*

Step 7:

Grasp the end of the wrapper and fold it back over the steel rollers while swinging the *outside cover* closed. (Figure 4-6).

Step 8:

When swinging the *outside cover* closed, make sure that the edge of the *wrapper* protrudes as shown. (Figure 4-7).

Step 9:

Lock the *outside cover* by swinging the *latch* downward to the left and hold there while pressing down on the *outside cover* to engage the locking catch. Continue to press downward on the *outside cover* with one hand while swinging the *latch* up and to the right as shown. (Figure 4-8).

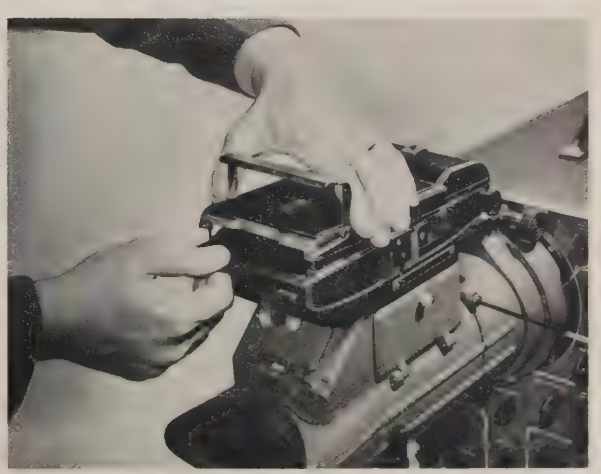

FIGURE 4-7
EXTENSION OF WRAPPER; *OUTSIDE COVER* CLOSED

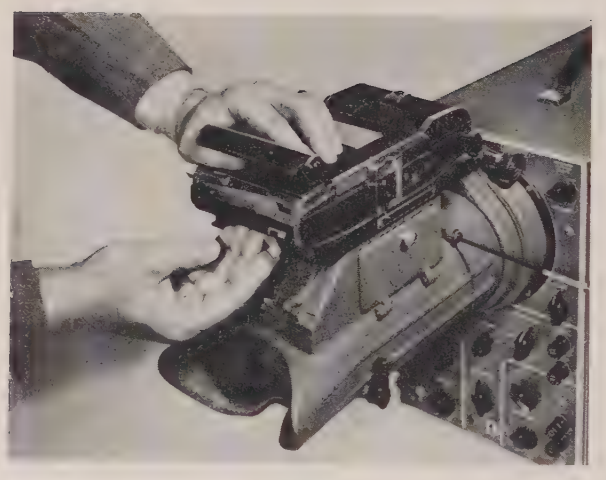

FIGURE 4-8
LOCKING THE *OUTSIDE COVER*

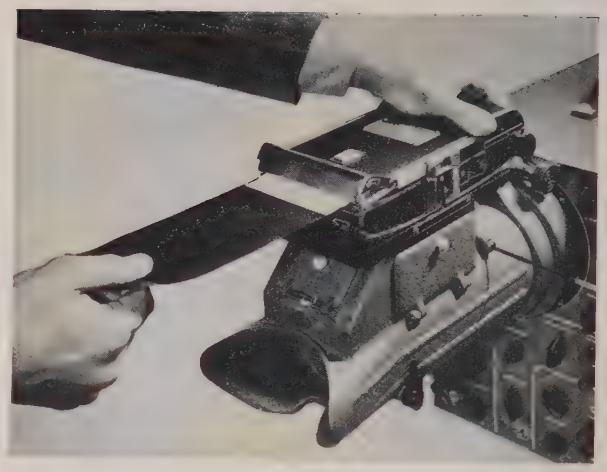

FIGURE 4-9
PULLING THE WRAPPER STRAIGHT OUT FROM THE CAMERA

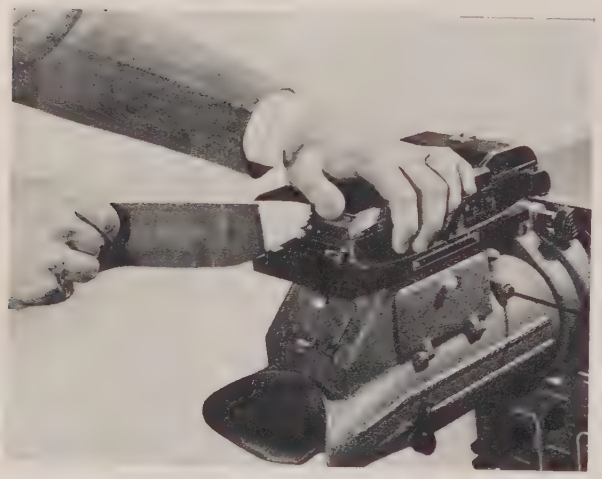

FIGURE 4-10
TEARING THE WRAPPER FROM THE CAMERA

FIGURE 4-11
ADJUSTMENT OF SHUTTER

FIGURE 4-12
ADJUSTMENT OF IRIS DIAPHRAGM

Step 10:

Grasp the edge of the protruding wrapper and pull straight out until the paper stops automatically and the word "stop" appears. (Figure 4-9).

Step 11:

Hold the cutter bar firmly down with your thumb, as shown, tear off and discard the paper. (Figure 4-10). This completes the loading operation.

3. TAKING THE PICTURE

A little experience will be required to determine the exact exposure time to use for photographing various phenomena. For the proper settings of the iris diaphragm and shutter, refer to Table 4-1.

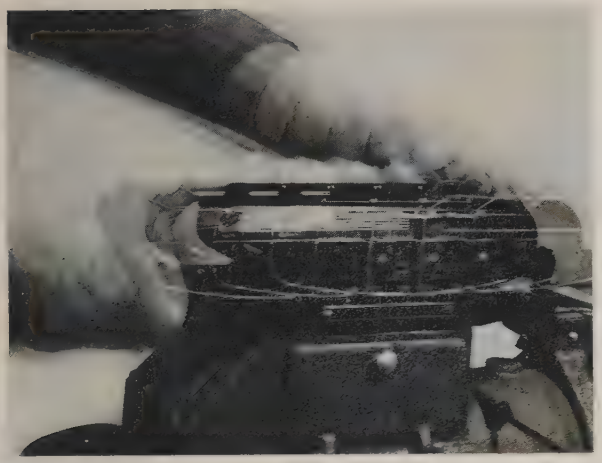

FIGURE 4-13
POSITIONING THE CAMERA

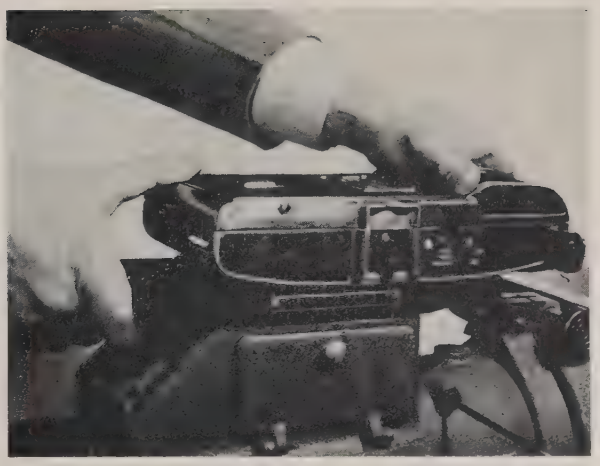

FIGURE 4-14
POSITION OF CAMERA FOR FIRST EXPOSURE

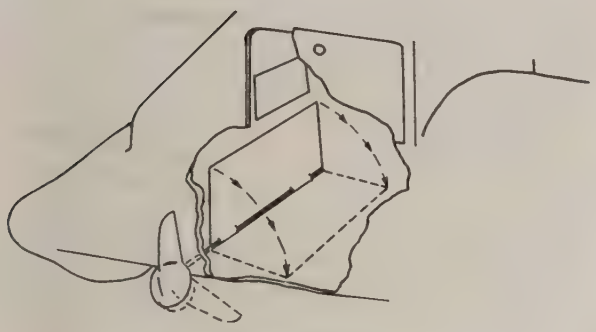

FIGURE 4-15
PHANTOM SKETCH OF VIEWING DOOR

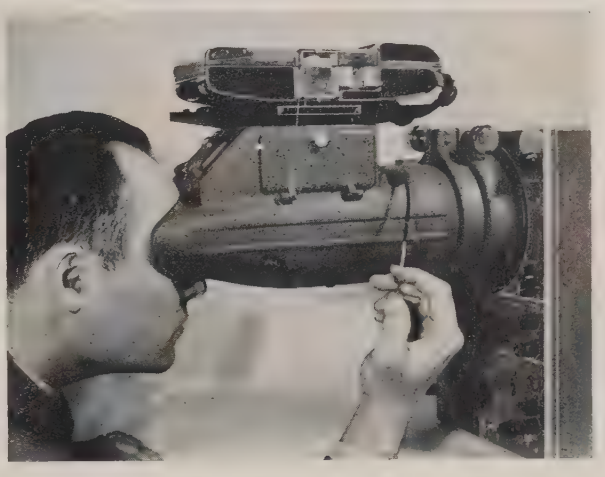

FIGURE 4-16
MAKING THE EXPOSURE

a. ADJUSTMENT OF SHUTTER AND IRIS DIAPHRAGM

To set the shutter, open the *lens-access door,* grasp the knurled ring on the lens and shutter assembly and rotate until the indicator line on the ring is aligned with the desired shutter setting. (Figure 4-11).

To set the *iris* diaphragm rotate the *pointer* over the diaphragm scale to the desired setting. Close the *lens-access door* after making these adjustments. (Figure 4-12).

b. POSITIONING THE CAMERA

To position the camera, make sure that the *slide-lock thumb screw* has been loosened. Grasp the camera with both hands as illustrated in Figure 4-13 and slide it to the extreme forward position. (Figure 4-14).

c. VIEWING THE TRACE.

Rotate the *viewing-door knob* clockwise until it engages the spring catch. It is now possible to observe the phenomenon to be recorded by looking through the *eye shield.*

d. ADJUSTMENT OF CRO INTENSITY

Adjust the oscillograph for the proper intensity and size of the waveform to be recorded. CAUTION: Be sure that *viewing door* is open before turning up the intensity on the oscillograph. NOTE: It is possible to take a picture with the *viewing door* open, provided a bright light source is not directly in the back of the *eye shield.*

e. EXPOSURE.

While observing the trace through the *eye shield* (be sure *viewing door* is open), make the exposure by depressing the *shutter cable-release.* The resulting print will be inverted with respect to the observed pattern on the screen, due to the single reflection from the dichroic mirror. However, the data record will not be inverted, provided it has been written on the ground-glass surface.

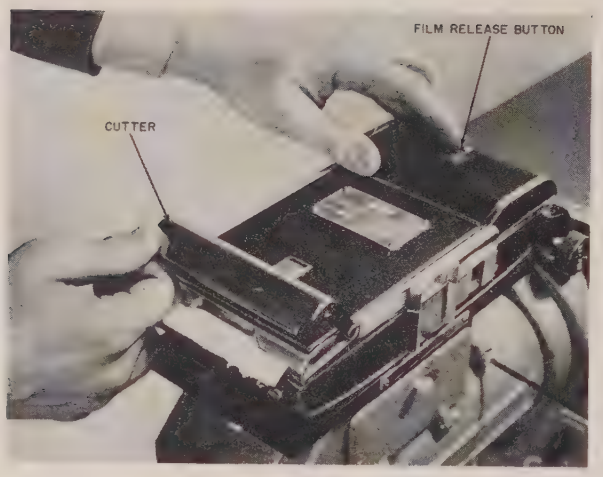

FIGURE 4-17
MOMENTARILY PRESSING THE FILM-RELEASE BUTTON

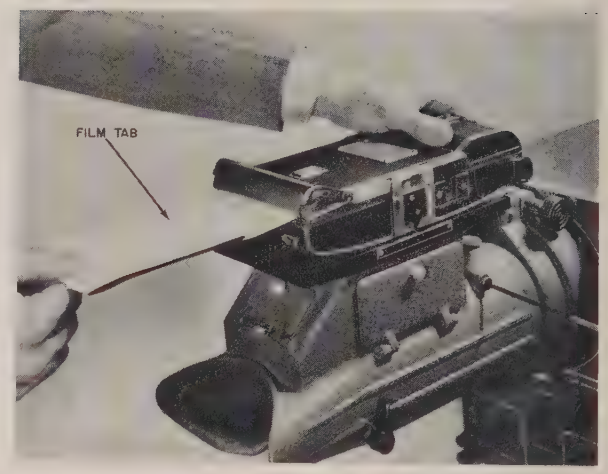

FIGURE 4-18
STARTING THE PROCESSING

4. RECORDING DATA ON THE POLAROID-LAND PRINT

Written data concerning the waveform being recorded may be photographed on the same print as the waveform itself by use of the data-record system. The surface on which the data is written is located as illustrated in Figure 2-1b.

To record data on the print:

a. Open the *data-record door,* and write on the ground-glass surface.

b. Close the door and press the push button on the left side of the camera. This illuminates the data surface.

c. Press the *cable release* allowing for approximately the exposure time shown in Table 4-2. Data may be double-exposed on the film with the oscillogram or may be recorded simulanteously by proper adjustment of both the cathode-ray beam intensity and the iris diaphragm. If simultaneous exposure of the data record and the oscillogram is desired, the iris diaphragm and intensity control settings should be adjusted so that the same exposure time yields a suitable record of both the data and the oscillogram. Otherwise the data and oscillogram exposures should be made separately according to the data given in Tables 4-1 and 4-2.

5. PROCESSING

Step 1:

Lock the *camera slide* by means of the *slide-lock thumb screw;* press the *film-release button* all the way in and release—DO NOT HOLD IT DOWN; lift the *cutter.* (Figure 4-17.)

Step 2:

Grasp the camera near the strap with one hand while pulling the *film tab straight out* to the automatic stop, evi-

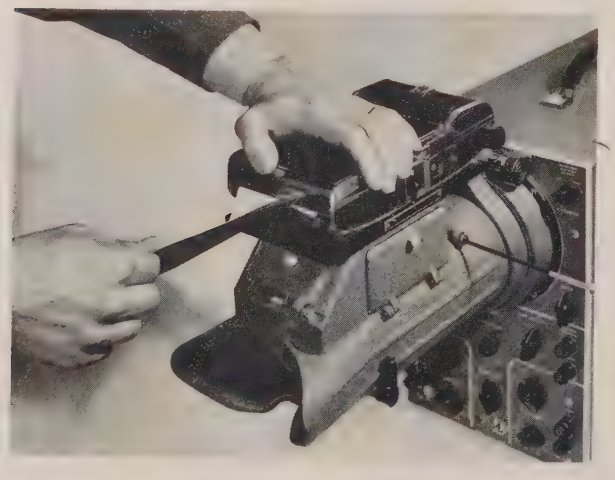

FIGURE 4-19
REMOVAL OF NEGATIVE FROM THE PREVIOUS PRINT

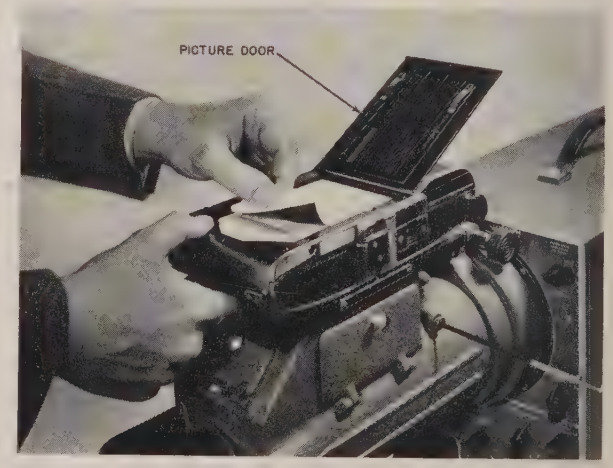

FIGURE 4-20
REMOVING THE PRINT AFTER PROCESSING

denced by a "click." The processing has now begun. Also, and film has been advanced for the next exposure. (Figure 4-18.)

Step 3:

Lower the *cutter* and hold it down with your thumb; tear off the *film tab* as shown. The next frame can be exposed, if desired, during the 60 second processing period.

(If you forget to lower and hold down the *cutter bar,* the tab will be lost for the next frame. If this happens, wait approximately one minute—processing time for the Polaroid print—and open the *picture door;* then inch the paper forward.)

After the first print has been processed, the discarded tabs will be the negatives from previous prints. (Figure 4-19.)

Step 4:

Wait approximately 60 seconds for the processing before opening the *picture door* by means of the *thumb latch.* Remove the print by lifting carefully along the perforations. Handle the print by the tab or white border. *Avoid finger-printing or scratching the fresh print.* (Figure 4-20.)

6. EXPOSURE OF SEVERAL WAVEFORMS ON A SINGLE PRINT

To make a series of consecutive (but not superimposed) exposures on the same print, move the camera body on its track in incremental steps following each exposure. The following technique is recommended to avoid obscuring some of the traces by the data record. Slide the camera to its forward position (see Figure 4-14) and expose the data record. The data will now be at the top of the frame as illustrated in Figure 4-21.

The camera may be left in this position to record the first oscillogram. However, be sure that the trace is positioned in the center of the screen. The amplitude should be adjusted to not more than approximately 1-1/2" to prevent the trace from overlapping the data record.

If it is desired to record three equally-spaced oscillograms on one frame (see Figure 4-21) three equally spaced detents have been incorporated on the *camera-slide* mechanism to facilitate equal spacing. For those applications requiring more than three oscillograms per frame or closer spacing of oscillograms, the *positioning pointer* located on the right side of the camera, can be aligned with the calibrated scale. To record a number of traces on each frame, the amplitude of the pattern should be decreased accordingly if overlapping is to be avoided. (See Figure 1-2.)

7. REPRODUCTION OF POLAROID-LAND PRINTS

The Polaroid-Land process ordinarily does not yield a negative suitable for reproduction in the conventional photographic process. The common procedure for obtaining reproductions is to have the print photo-copied; the new negative is then used to make the desired number of prints. It is possible, however, to fix permanently the original paper negative. The following procedure is recommended for fixing:

a. Make the recording and commence the processing as outlined in Paragraphs two and four of this section.

b. Approximately one minute after processing, place a black cloth over the top of the camera and open the *picture door.*

c. Peel off the print, then immediately close the *picture door.* The negative of this print remains in the camera and will not fog as long as it is not exposed to light.

d. When starting the processing of the next print, pull the negative of previous print out under the *dark cloth* or in a *dark*-end room, and after tearing this negative off, immediately immerse it in a jar or tray of hypo. A concentrated hypo solution such as Kodak Rapid Fixer Solution is recommended. The paper negative should remain in the hypo for approximately two minutes; meanwhile the next exposure can be made.

e. After fixing, the paper negative may be washed and dried in the usual manner. This negative may subsequently be printed by the Diazo or other dye process for engineering reports or may be contact-printed on photographic paper. To print the negative on sensitized paper, choose a medium or soft contact paper such as Azo No. 2. Place the emulsion side of the negative in contact with the emulsion of the photographic printing paper and expose through the negative. Process the contact print in the usual manner. To improve the appearance of the contact print, rub the back of the negative with oil, vaseline or melted wax to render it translucent, thereby facilitating the transmission of light through the negative for contact printing. In a similar manner the Polaroid print itself may be reproduced. However, in this case, a contact negative will result. Advantage can be taken of this effect by contact-printing the Polaroid print onto a sheet of negative material for the subsequent use of making the desired number of positive duplicates.

8. FOCUS

The focus of the Type 297 Camera *has been set* at the factory so that, when the rubber-trimmed end of the housing is in contact with the face of a 5-inch cathode-ray tube. the camera is in focus. Moreover, the depth of field of the lens is sufficient that correct focus is assured even with an 1/8" calibrated scale and 1/16" filter over the face of the cathode-ray tube. When using the camera with an instrument equipped with a calibrated scale, be sure that the face of the cathode-ray tube is in close contact with the scale. If it is ever required to refocus the camera for extra thick calibrated scales (1/4 inch or over) or for any other applications, refer to Section VI, Paragraph 3 on Maintenance.

TABLE 4-1

AVERAGE EXPOSURE GUIDE FOR DU MONT CATHODE-RAY OSCILLOGRAPHS

(With stationary pattern of ten sine wave wave cycles on screen and medium intensity settings)

Polariod-Land Film Types 40 and 41
Development Time: One Minute
Type 297 Oscillograph-record Camera
Object to Image Ratio—2.25

Du Mont Oscillograph Type No.	*Cathode-ray Tube*	*Accelerating Voltage*	*Diaphragm Setting*	*Exposure Time Seconds*
208-B	5LP11-A	1400	5.6	1
241	5JP11-A	1500	5.6	1
247-A +263-B	5RP11-A	11,500	11	1/2
248	5JP11-A	4000	8	1/2
248-A +263-B	5RP11-A	12,000	11	1/2
250-A	5CP11-A	3200	11	1
250-AH +263-B	5RP11-A	13,700	16	1/2
256-D, 256-E	5CP11-A	4000	8	1/2
274-A	5BP11-A	1000	4	1
275-A	5CP11-A	3000	11	1
280-A	5XP11-A	11,900	11	1/2
288-A	5XP11-A	20,000	16	1/2
281-A	5RP11-A	8000	16	1
281-A +263-B	5RP11-A	14,000	16	1/2
281-A +286-A	5RP11-A	29,000	22	1/2
294-A	5XP11-A	12,000	11	1/2
303, 303-A	5YP11-A	3000	8	1
304	5CP11-A	1780	8	1
304-H	5CP11-A	3000	11	1
322	5SP11	3000	11	1

NOTE: To obtain approximate exposures for other screen types, multiply the above exposures by the following factors: P1—4 times; P2—5 times; P7—2 times.

In general, the values shown in Table 3-1 are intended for use where the pattern consists of a series of ten sine waves which have a vertical amplitude of two inches and which are spread across the width of the tube screen. If the total distance traversed by the spot of a cathode-ray tube varies appreciably from these conditions, the exposure should be varied proportionately. For example, if the entire pattern is condensed into a smaller area on the screen, more energy is concentrated over a small portion of the phosphor resulting in higher brightness and making it necessary to decrease exposure.

9. EXPOSURE DETERMINATION

a. GENERAL.—For the great majority of applications, "bulb" operation is most desirable. A few of the factors which affect the setting of the iris diaphragm and the time interval for holding the shutter open are:

1. The over-all accelerating potential of the oscillograph.
2. The actual brightness setting of the oscillograph's INTENSITY control.
3. The amplitude of the pattern on the cathode-ray screen.
4. Whether the sweep is "recurrent" or "driven."
5. Sweep repetition rate.
6. Whether the pattern is stationary, jittery, or drifting.
7. The number of cycles appearing on the screen.
8. The age of the particular cathode-ray tube.
9. The type of screen phosphor.
10. The type of film used in the camera.

Besides the foregoing list, there are a number of other conditions which would have to be considered if it were necessary to calculate the exact proper exposure. Obviously it would be extremely difficult or even impossible to take every one of these factors into account and provide accurate exposure data for every conceivable situation. It

is usually adequate to divide exposure data into two general classifications, one for the photography of stationary patterns and the other for the photography of single and repetitive transients.

b. STATIONARY PATTERN RECORDING.—To photograph patterns, it is only necessary to open the camera shutter for the duration of at least the time of one sweep cycle in order to avoid losing part of the pattern. However, if only one cycle is exposed, the actual density obtained is limited by the effective brightness of the trace on the cathode-ray tube. The exposure is by no means critical since an overexposure of ten times or underexposure of ten times will still yield a suitable oscillogram in the majority of applications, due to the wide latitude of present-day photographic emulsions. For best results in a particular application, several test exposures should always be made. Table 3-1 may be used as a guide in determining suitable exposures for stationary patterns. These figures are not intended to be followed blindly but should serve rather as a starting point to enable experimental determination of optimum results for individual cases. Experimental determination of optimum exposure is greatly facilitated by the fact that a finished oscillogram is ready one minute after exposure.

c. TRANSIENT RECORDING.—For single-transient recording, the aperture is generally set at maximum opening with the shutter being opened before the transient occurs and closed after it is over. In this case, it is only a question of whether the writing speed of the spot is such that the particular combination of cathode-ray tube, oscillograph, recording material, lens, and processing procedure is adequate for obtaining useful density. Under certain conditions, holding the shutter open while waiting for a transient to occur or be energized may result in excessive fogging of the film. Unless the oscillograph has automatic beam blanking, fogging of the film will occur as a result of the bright spot on one side of the screen. This effect is best minimized by painting on the face of the tube over the area where the stationary spot is located, using optical-black paint. With automatic beam blanking, the above source of fogging is eliminated: However, some fogging may still occur under conditions of very long exposure due to light from the filament of the cathode-ray tube ("cathode glow") reaching the film. The "cathode" type of fogging is reduced to a minimum in the Type 297 Camera through use of the blue-reflecting dichroic mirror which absorbs most of the red-orange light.

Secondary emission effects in the cathode-ray tube also may cause film fogging. A discussion of these effects is beyond the scope of this manual but may be found in the literature on photo-recording. If necessary, however, such effects may be further minimized by use of the appropriate Du Mont color filter, such as the Du Mont Type 2560-E, in front of the cathode-ray tube.

d. PRE-SENSITIZING.—The two types of Polaroid-Land recording material will not ordinarily record as high writing speeds as will conventional photographic film, despite the fact that the (American Standards Association) Speed Index Rating (100) is the same as that for Super XX film. Complete data on writing rates for the various oscillographs is not yet available since the film manufacturer has been continuously improving the quality of the recording material with resultant improvement in writing rates.

It is possible to greatly increase the actual photographic writing speed of the recording material by pre-sensitizing the emulsion before recordings are made. The recommended procedure for pre-sensitizing Polaroid-Land film material is as follows:

1. Load the film into the camera.

2. Set up the camera as shown in Figure 3-1 against a sheet of white opal glass six inches away from a 25-watt incandescent lamp.

3. Expose for 1/25 of a second at f/2.8. Improvement of maximum photographic writing speed[1] by a factor as high as 8 times can often be obtained.

10. DATA-RECORD EXPOSURE

Table 4-2 may be used to calculate the approximate proper exposure time for the illuminated data surface. When exposures several times longer than the value listed in Table 4-2 are required, the leak-proof dry cell should be replaced. The exposure times and aperture settings which yield optimum results depend upon:

a. The softness of the pencil used.

b. The amount of pressure used in writing on the ground-glass surface.

Eradication of data from the ground-glass surface is easily accomplished by the use of a good pencil eraser.

[1] Maximum photographic writing speed as specified for Polaroid-Land recording is here defined as the writing speed which yields a barely visible but readable trace on the resulting print as viewed by reflected light. To some extent this depends upon the observer and the manner in which the print is held under the ambient illumination. In many cases it will be found necessary to greatly over-expose the low writing speed portion of the transient in order to see the high-writing speed portion.

TABLE 4-2

Optimum Data-record Exposure for Type 297 Oscillograph-record Camera

Illumination: 2 Mazda No. 112 Lamps
1 Leak Proof, Size C, Dry Cell

Aperture	*Time—Seconds*
f/1.9	1/2
2.8	1
4	2
5.6	4
8	8
11	16
16	30
22	60

NOTE: These exposure times are for handwritten data on the ground-glass surface with a No. 2 soft pencil and for a fresh dry-cell. For good results it is recommended that only the first four apertures listed be used for data-record exposure.

During exposure, the data may be observed through the eye shield. If higher contrast is desired than can be obtained using a pencil the data may be written on a strip of thin vellum using black ink. The strip of vellum can then be inserted between the ground-glass surface and the data-record door. Writing on a carbon backed strip of white paper will also photograph well.

This type of data recording system also makes it possible to record such items as the face of a watch or counter. To record the face of a watch, it is advisable to remove the ground-glass window of the data chamber. The watch or counter face should then be placed in the plane of the opening. To obtain the desirable contrast between the digits of a watch or a counter and its face, utilization of white numbers on a black or dark background is recommended.

SECTION V

MAINTENANCE

1. GENERAL

The Type 297 Camera should be handled with the same care given to all fine optical equipment. Under no circumstances should an attempt be made to force fit parts.

The focus should not be readjusted unless there is reason to believe from observing recordings that the camera is out of focus. For the majority of work the depth of field of the lens, even with the aperture wide open, is sufficient to accommodate curved-face cathode-ray tubes even when screens and filters are inserted between the camera housing and the cathode-ray screen.

2. ROUTINE MAINTENANCE PROCEDURE

a. DRY CELL REPLACEMENT.—The 1.5 volt dry cell. located in the data record chamber, should be replaced whenever exposure time for making suitable data records become appreciably greater than the values listed in Table 4-2. Remove the data-light assembly bracket as described under Installation (Section II, Paragraph 2).

b. DUSTING MIRROR AND LENS.—It may occasionally be necessary to remove dust particles from the dichroic beam-splitter, data-record mirror, or surface of the objective lens. These surfaces should only be cleaned with a fine lens tissue or by dusting with a soft camel hair brush.

3. REFOCUSING THE CAMERA

The lens of the camera has been set at the factory to be in optimum focus when the end of the barrel is in contact with the cathode-ray tube. If it is convenient for special applications to so position the camera, the focus may easily be readjusted. To record the highest possible writing speeds, it is recommended that the focus be adjusted for optimum. Focusing is accomplished as follows:

a. Mount the camera on the oscillograph with which it is to be used.

b. Open the *camera-back* as when loading film. (See Figures 4-2 and 4-3.)

c. Set the shutter on "time," the iris diaphragm at maximum opening (smallest "f" number), and operate the cable-release to open the shutter.

d. Rotate the *viewing-door knob* clockwise until it locks on the spring catch.

e. Place a stationary pattern on the cathode-ray tube screen. Adjust the trace for the proper intensity, size, and focus. CAUTION: *Be sure that the viewing door is open before turning up intensity on the oscillograph.*

f. Place a sheet of 3-3/8 x 4-1/4 ground glass in the focal plane with the ground surface facing the lens.

g. Slightly loosen the two *focus set-screws* in the lens adaptor assembly. These screws are accessible through the *lens-access door. Hold the lens assembly with one hand while loosening these screws.*

h. While observing the image on the ground glass with a magnifying glass, slide the lens assembly up and down until the sharpest focus is obtained. Then lock the two *set-screws.*

When the lens is refocused for any reason, the data-record image in the focal plane should be checked and, if necessary, readjusted for best focus and proper location of the image in the focal plane. The mirror may be adjusted in a horizontal direction to correct the focus by loosening the small screw holding the data-record mirror bracket inside the bottom of the housing. The bracket is slotted so that the data-mirror assembly may be slid back and forth. The correct position of the data image in the focal plane is at the bottom of the oscillogram close to the edge of the square frame opening. If it becomes necessary to reposition the image of the data in the focal plane, the data mirror should be removed from the housing and the angle of the mirror in its bracket changed slightly. CAUTION: *Avoid touching the surface of this mirror.*

4. CHANGING THE LENS ASSEMBLY

Cameras normally supplied with the f/2.8, 75mm lens assembly may have a f/1.9, 75mm lens assembly installed. To change the lens assembly, proceed as follows:

a. Loosen the *slide-lock thumb screw* which locks the sliding mechanism and slide the *camera-back* to the the extreme forward position. (Barrel end of camera housing.)

b. Remove the 2-56 screw and the 1/4" block located above the grooved adaptor plate.

c. Slide the *camera-back* in the reverse direction of that previously indicated, and lift it completely off the grooved plate.

d. To unscrew the *cable release* from the shutter-cable-release socket, insert hand in the barrel end of the camera housing and loosen the knurled cable-release bushing.

e. Remove the two large flat head screws which hold the grooved adaptor casting to the mirror housing.

f. Lift the grooved adaptor casting containing the lens assembly from the camera housing.

g. Remove the three small flat-head screws which hold the lens assembly in place.

h. Remove the entire lens assembly and replace with the new one, utilizing the same three small flat-head screws.

i. If an f/1.9 lens assembly is to replace an f/2.8 lens assembly, the thin metal light baffle which is mounted in

the mirror housing on the two upper beam-splitter circuit bosses must be modified. Remove this metal baffle and trim the leading edge with a pair of shears so that it will clear the outside diameter of the front lens ring.

j. Replace the grooved adaptor casting. By means of the two large flat-head screws, slide the camera back into place and replace the 1/4" block.

k. Refocus the camera as described in Paragraph 3.

5. WARRANTY

Each Oscillograph-record Camera manufactured by the Instrument Division of Allen B. Du Mont Laboratories, Inc., is sold under the Du Mont Guarantee. For terms and conditions of this guarantee, see inside back cover.

6. THE DU MONT "OSCILLOGRAPHER"

The Du Mont "Oscillographer," a quarterly publication, is published regularly by the Allen B. Du Mont Laboratories, Inc. It is sent free of charge to engineers, research workers, and those engaged in the application of cathode-ray equipment. When sending requests for subscriptions and address-change notice, please supply the following: Name, company name, company address, type of business, and title of individual.

7. A PARTIAL LIST OF REPLACEMENT COMPONENTS

A partial list of replacement parts for the Type 297 Oscillograph-record Camera is given below.

Description	*Part Number*
Adaptor, Clamp Ring Assembly	35009631
Assembly, Data-record Mirror	48002863
Battery	29000570
Body, Camera	48003031
Bracket, Assembly Data Lamp Reflector	35010172
Bushing, Cable Release	43001451
Glass, Data Record	45002531
Lamp, Mazda	48002912
Lens Assembly, f/1.9	48003011
Lens Assembly, f/2.8	48002791
Mirror, Data-record	48002841
Mirror, Dichroic	48002711
Plate, Data-record	30015792
Release, Shutter, 10-inch	48003080
Ring, f/1.9 Lens Adaptor	3501064(3)
Ring, f/2.8 Lens Adaptor	3501063(3)
Shield, Light	42003831
Spring, Retainer	30016501
Switch, Push-button	05004440
Thumb Screw, Spring Lock	60903231
Washer, Cable Release, Rubber	62401151

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WARRANTY AND SERVICE NOTICE

for

Industrial Type Cathode-ray Tubes and Instruments

DU MONT INSTRUMENTS

Each instrument manufactured by the Instrument Division of Allen B. Du Mont Laboratories, Inc., is guaranteed to equal or exceed its published performance specifications. It is further guaranteed against defective materials (other than the cathode-ray tube) and workmanship for a period of one year from date of delivery. Any defective instrument or an instrument that does not meet or exceed our specifications will, upon inspection by us, be repaired or replaced at our discretion should such defect appear within the guarantee period.

To register this guarantee, the enclosed guarantee card must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. BOTH THE TYPE NUMBER AND THE SERIAL NUMBER OF THE INSTRUMENT MUST BE GIVEN ON THIS CARD.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

DU MONT CATHODE-RAY TUBES

Industrial type cathode-ray tubes manufactured by Allen B. Du Mont Laboratories, Inc., are guaranteed for 1000 hours of operation or for a six-month period of installation, whichever shall first expire. The right is reserved, however, to limit claims to a period of nine months after shipment from the factory. Adjustments will be made on the merit of each individual claim because of the widely varying applications to which such tubes are subjected, and a tube which becomes defective during the guarantee period will be replaced ONLY AFTER INSPECTION AT THE FACTORY. Cathode-ray tubes which are sent in under the guarantee, must be sent with transportation paid.

BURNED OUT HEATERS AND BROKEN GLASS ARE NOT COVERED BY THE TUBE GUARANTEE

To register a tube guarantee, the guarantee card enclosed with the tube must be properly filled out and mailed to the factory immediately upon receipt of the equipment. Complete information is necessary. TYPE NUMBER AND SERIAL NUMBER OF THE CATHODE-RAY TUBE MUST BE INCLUDED. The serial number of the tube will be found either on the glass stem of the electron-gun structure or on the bulb near the Du Mont brand. Tubes must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications excepting under the classification of special apparatus.

SERVICE

In order to insure factory service under our guarantees, the guarantee cards enclosed with all instruments and tubes must be properly filled out and returned. In all cases where service or adjustment is requested, please write first to the factory giving complete information concerning the nature of the failure and describing the manner in which the equipment was used when failure occurred. THE TYPE NUMBER AND SERIAL NUMBER of the equipment must also be given. In this way, much time can be saved and unnecessary inconvenience often avoided. When writing in this respect, address:

Allen B. Du Mont Laboratories, Inc.
Instrument Service Department
1500 Main Avenue, Clifton, New Jersey

The Instrument Service Department will then send to the customer, the written procedure for sending the instrument back to the factory. All equipment should be packed and shipped in accordance with this procedure; and identification tags should be attached to each tube or instrument.

REPLACEMENT PARTS

If it is necessary to order a replacement component from the factory, always give the type number and serial number of the instrument and refer to the component by its symbol designation and description on the circuit schematic. This will help to expedite service.

DU MONT

Additional copies of this manual may be secured at a cost of two dollars each or twenty dollars per dozen copies; postpaid in the United States of America only.

Allen B. Du Mont Laboratories, Inc.

Instrument Division

1500 MAIN AVENUE, CLIFTON, NEW JERSEY